MECHANICALLY SEALED ADJUSTABLE GAS NOZZLE

Background of the Invention

[0001] This invention relates to a nozzle for gas-heated appliances and more particularly, to a nozzle which may be used with appliances that burn natural gas or liquefied petroleum (LP) gas and which may be used in very high temperature burning environments as well as in lower conventional lower temperature environments. For example, the gas in appliances such as gas water heaters, gas furnaces, gas ovens and gas clothes dryers operate at conventional burning temperatures in the order of approximately 500 degrees to 550 degrees Fahrenheit while the temperature in the cleaning cycle of self-cleaning ovens may be in the order of approximately 900 degrees Fahrenheit. In these high temperature environments, it is important that the seals in the nozzles used to dispense the gas into the combustion chamber of the appliance do not fail or distort so as to prevent the gas from bleeding back and thereafter being drawn into the flame at rates above that desirable or building up potentially to cause an explosive environment.

[0002] The present invention is an improvement over the nozzle construction illustrated in U.S. Patent No. 5,025,990 which is assigned to the common assignee of the present invention. In the nozzle of the aforesaid patent, although not illustrated, there traditionally may be an O-ring or may be a grease or wax seal between the nozzle body and the threaded conduit which supports and positions the insert to permit the outlet orifice to be either restricted for use with LP gas or unrestricted for use with natural gas. These seals under the high temperature conditions in a self-cleaning oven cycle may be subject to problems such as heretofore described.

Summary of the Invention

[0003] Consequently, it is a primary object of the present invention to provide a mechanical seal between the nozzle body and the adjustable gas nozzle and a conduit which couples to the

nozzle body and supports a flow adjustment member, the seal being downstream of the location where the conduit couples to the nozzle body.

[0004] It is another object of the present invention to provide a mechanical seal between the nozzle body of an adjustable gas nozzle and a conduit which is threadably coupled to the nozzle body and supports a flow adjustment member, the seal comprising at least one radial ring on the conduit contacting and sealing against a smooth bore inner diameter of the nozzle body.

[0005] It is a further object of the present invention to provide an adjustable gas nozzle having a flow adjusting member positioned within a nozzle body supported on a conduit about which the nozzle body is threadably received, the adjusting member being moveable alternatively into or out of engagement with an interior wall of the nozzle body and having a configuration that permits gas to flow within a hollow therein and to the outlet orifice of the nozzle body at a first flow rate when it is in engagement with the interior of the nozzle body and to provide a flow path about the adjusting member for the gas to flow thereby to provide additional gas to flow through the outlet orifice of the nozzle body when out of engagement with the interior of the nozzle body.

[0006] Accordingly, the present invention provides an adjustable gas nozzle having a nozzle body including a passageway therethrough opening into a first orifice at one end and an internal sealing surface adjacent thereto, a threaded internal surface at a second end, a conduit connected to a source of gas at one end and having external threads adjacent a second end threadably receivable within said second end of the nozzle body and moveable between first and second alternative positions relative to said nozzle body, integral radial ribs disposed externally about the conduit intermediate the external threads and the second end of the conduit and engageable with the internal surface of said nozzle body intermediate said sealing surface and said threads, and a flow adjusting member supported within said conduit and moveable toward and away from

said first orifice as the nozzle body is threadably moved about said conduit, the adjustment member having an interior passageway communicating the conduit with the first orifice and having an external surface for cooperatively engaging said sealing surface of the nozzle body in one alternative position and spaced therefrom in a second alternative position, the flow of gas through said first orifice varying dependent upon which alternative position is selected.

[0007] The radial ribs on the exterior of the conduit have a larger diameter than the internal diameter of the engageable interior surface of the nozzle body so that deformation occurs therebetween resulting in a tight seal when the nozzle and the conduit are coupled. Preferably the material of the conduit is harder than the nozzle so that the ribs deform the wall of the nozzle.

[0008] The flow adjusting member comprises an insert or body member having an orifice at an end thereof for communicating the flow of gas to the first orifice, the orifice in the adjusting member being smaller and thus more restrictive than the first orifice so that the gas flow rate is determined by the more restrictive orifice when the exterior surface of the adjusting member engages the sealing surface of the nozzle body. The adjusting member has a plurality of spaced apart elongated legs extending from a portion of the exterior surface, the legs being positionable on an interior surface of the conduit, a path being provided for flow of gas over the exterior surface intermediate the legs which flow communicates with the first orifice when the adjusting member is disengaged from the sealing surface.

Brief Description of the Drawings

[0009] The particular features and advantages of the invention as well as other objects will become apparent from the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a longitudinal sectional view of an adjustable gas nozzle constructed in accordance with the present invention; and

Fig. 2 is a partly exploded perspective thereof with the nozzle body removed from the conduit.

Description of the Preferred Embodiment

[00010] The adjustable gas nozzle **10** illustrated in the drawings comprises three main elements: a conduit **12** for receiving gas from a source (not illustrated), a nozzle member **14** for supplying a jet of the gas to the burner section of an appliance (not illustrated), and a flow adjusting member **16**.

[00011] The nozzle member **14** has a gas passageway **18** which is coaxial therethrough about a longitudinal axis **20** with a threaded inlet opening at a first end **22**. The threads **24** on the nozzle body member **14** coact with threads **26** adjacent the open end 25 thereof on the exterior surface of the conduit **12** which is coaxial with the axis of the nozzle body member. A second end of the nozzle body member has a coaxial outlet **28** and the nozzle body member effectively is an annular member having an inner circular surface **29**, part of which is a conical surface **30** defining part of the passageway through the nozzle.

[00012] The flow adjusting member **16** has a longitudinal passageway therethrough coaxial with the axis **20** of the conduit and the nozzle body member. The flow adjusting member **16** is an insert that has an external circular surface **32** which is also conical at the same angle as the conical surface **30** of the nozzle body member. The internal conical surface **30** of the nozzle body member **14** is adapted to seal with the external conical surface **32** of the adjusting member when the nozzle body member is threaded onto the conduit **12**, except that the tip end **34** does not make contact and thus will not crush inwardly to make the outlet **36** of the adjusting member

more restricted. This outlet **36** of the adjusting member is a first restricted orifice and the outlet **28** of the nozzle body member is a second restricted orifice, the first restricted orifice **36** being smaller in diameter than the second restricted orifice **28** in the preferred embodiment.

[00013] A small shoulder **38** upset out of the inner wall of the conduit is adapted to support a plurality of elongated legs **40,42,44** integral with and projecting out of the exterior wall of the adjusting member **16** at the end of the adjusting member remote from the outlet to limit the position of the adjusting member **16** when the surfaces **30** and **32** are in sealing engagement. Preferably, as in the preferred embodiment, there are three such legs and the space between each such pair of legs provides a flow path **46** for gas to flow from the conduit toward the nozzle body member **14** thereby to provide a by-pass about the central flow path **48** in the adjusting member in the space at the interior of the conduit and the nozzle body member. Thus, when the nozzle body member **14** is threaded onto the conduit **12** tightly, the exterior conical surface **32** of the adjusting member **16** engages the internal conical surface **30** of the nozzle body member and precludes flow through this by-pass passageway and all the gas flows out the orifice **36**. However, if the nozzle body member is not tightly threaded onto the conduit so that the exterior conical surface **32** of the adjusting member does not tightly contact the interior conical surface **30** of the nozzle body member, gas passes through the by-pass passageway **46** and may flow through the orifice **28** in the nozzle body member. Gas also at this time passes through the central flow passageway **48** of the adjusting member and this restrictive flow together with the flow in the bypass passageway may flow through the larger orifice **28** in the nozzle body member. If the nozzle body member is tightly threaded onto the conduit so that the two conical surfaces **30,32** seal one against the other, all the flow through the nozzle orifice **28** results from the flow through the more restrictive orifice **36** in the adjusting member which is the case when

LP gas is the source of combustion. When the gas flows through both the central bore **36** in the adjusting member and in the by-pass passageways **46** the adjustable nozzle may be used with natural gas.

[00014] Intermediate the open end **25** and the threads **26** of the conduit **12** of the adjacent interior wall **29** of the nozzle body member spaced intermediate the conical surface **30** and the first end **22** is a sealing means for precluding leakage of gas from the passageway **18** back between the nozzle body member and the conduit. In the prior art such sealing means was grease, wax or an O-ring. However, as aforesaid, when operating in a high temperature environment, these seals may fail thereby resulting in a blow-back of gas past the threads **24,26** and dispersing of the gas into the appliance combustion chamber resulting in higher temperatures therein or a possible build-up of an explosive environment.

[00015] Consequently, in accordance with the present invention, there is at least one, and preferably two, integral ribs or ridges **50,52** formed preferably on the exterior wall of the conduit **12** of a diameter such as to securely engage and seal with the interior wall **29** of the nozzle body member as the threads **24,26** couple. The material of one of the nozzle body member or the conduit is harder than the other and the fit is an interference fit so that the ribs **50,52** or the wall will deform as they engage. Preferably, the conduit is constructed from steel tubing or the nozzle body member is a softer brass alloy and therefore the wall **29** will form as a nozzle body member **14** is threaded onto the conduit **12**. Of course, the nozzle body member may be made from a harder material than the conduit, and in that case, the ribs will deform. In this manner, a good seal is made between the nozzle body member and the conduit that is unaffected by the temperatures encountered in the environment of the gas appliance.

[00016] In the preferred embodiment, the adjusting member **16** is also formed from a brass alloy so that when the nozzle body member **14** is tightened onto the conduit **12**, the conical surface **32** of the adjusting member will make a good seal against the conical wall **30** of the nozzle body member. As aforesaid, and as described in the aforesaid Patent No. 5,025,990, when this occurs all the gas flows through the central passageway **48** of the adjusting member and through the more restricted orifice **36** out through the larger orifice **28**. This is the position when LP gas is utilized in the appliance. When natural gas is utilized, the nozzle body member is more loosely threaded onto the conduit so that the surfaces **30** and **32** do not seal. In this case, gas not only flows through the passageway **48** but also through the passageway **46** so the orifice **28** receives a greater supply of gas to be sprayed into the combustion chamber of the appliance.

[00017] Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to the preferred embodiment of the invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

[00018] Having thus set forth the nature of the invention, what is claimed herein is: